(12) UK Patent Application (19) GB (11) 2 446 778 (13) A

(43) Date of A Publication 27.08.2008

(21) Application No: 0701964.9

(22) Date of Filing: 01.02.2007

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(51) INT CL:
A61J 1/00 (2006.01)

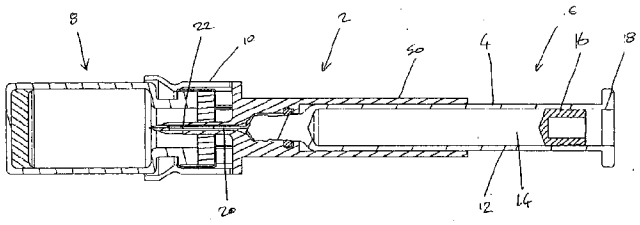
(56) Documents Cited:
US 3796218 A **US 20050137523 A1**

(58) Field of Search:
INT CL **A61J**
Other: **Online: WPI, EPODOC**

(54) Abstract Title: **Syringe adaptor**

(57) The adaptor 2 comprises a housing arranged to mount on and seal with a syringe 6 so as to define a cavity 30 within which the needle of the syringe can extend without the needle tip contacting the housing. The adapter also comprises a puncture member 40 extending from the housing having at least one port arranged to provide fluid communication between the interior of a vial and the cavity. The adaptor may be used to puncture the septum 38 of a vial using the puncture member, whereupon the contents of the vial may be drawn into the syringe via the at least one port, the cavity and the needle. The syringe may then be removed from the adaptor. The adapter may comprise an attachment member 10 to engage with the vial and O ring 32 to form a seal with the neck of the syringe.

Fig 2



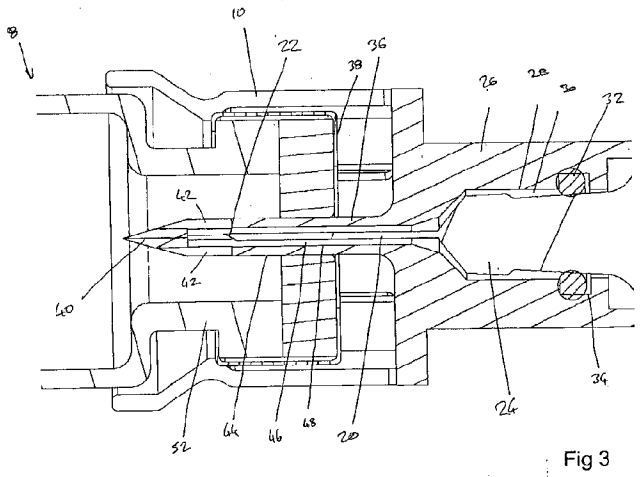


Fig 3

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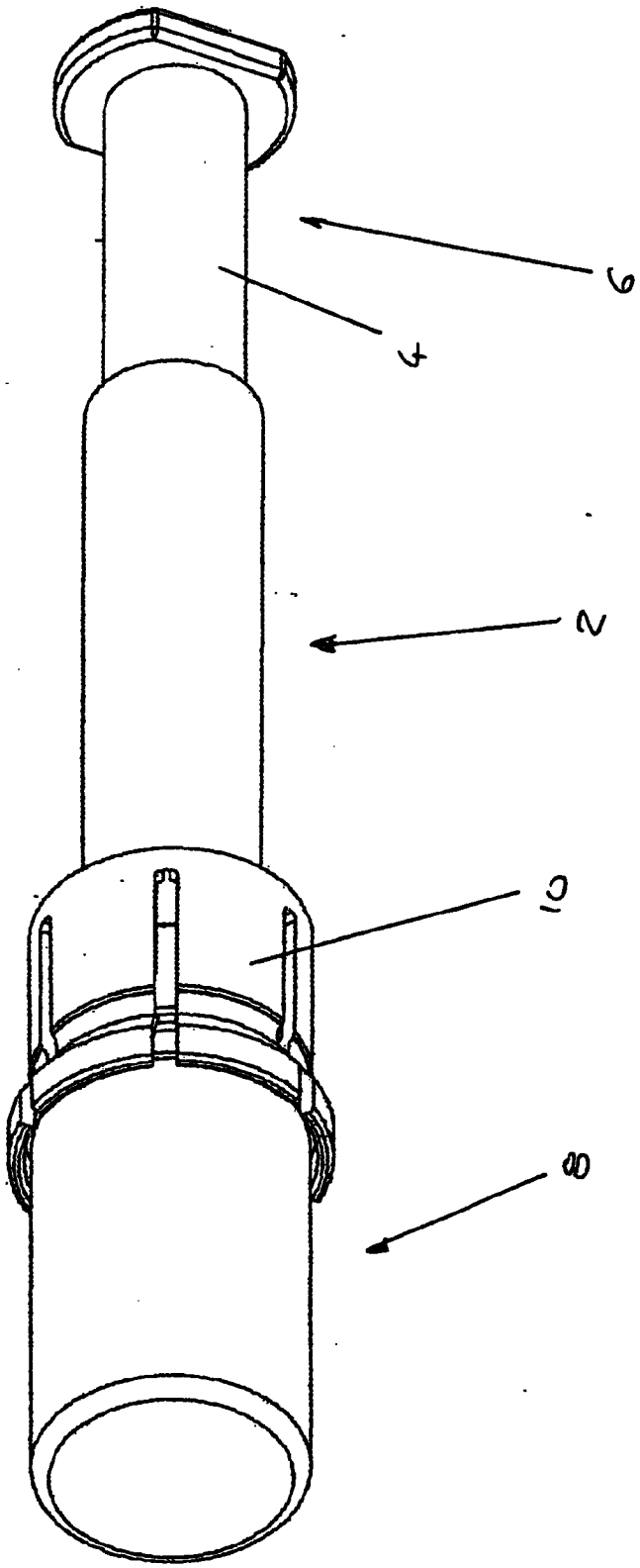


Fig 1

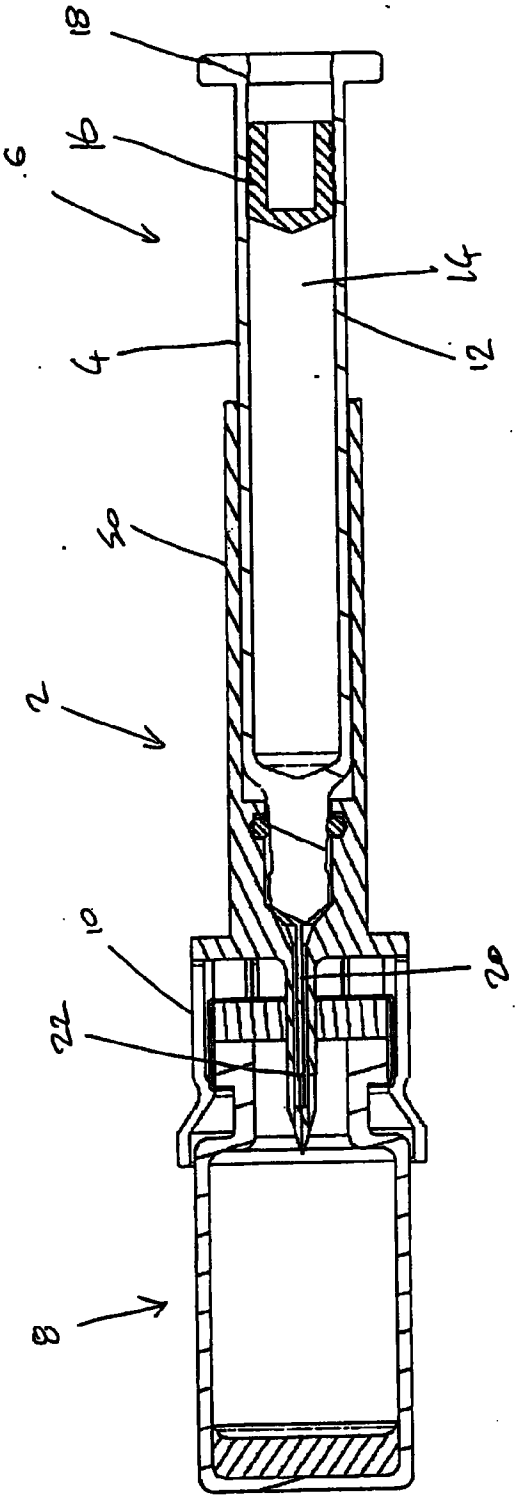


Fig 2

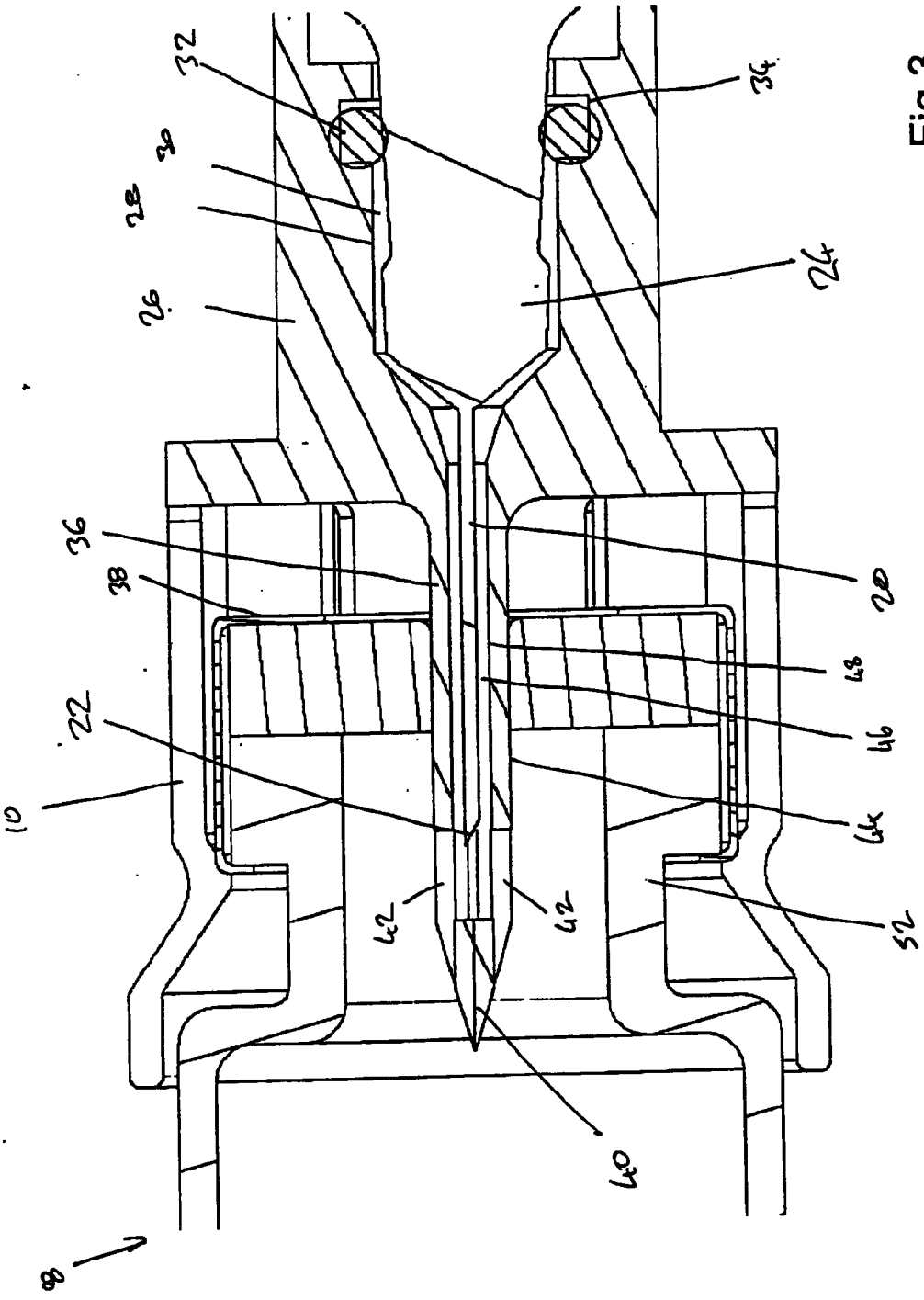


Fig 3

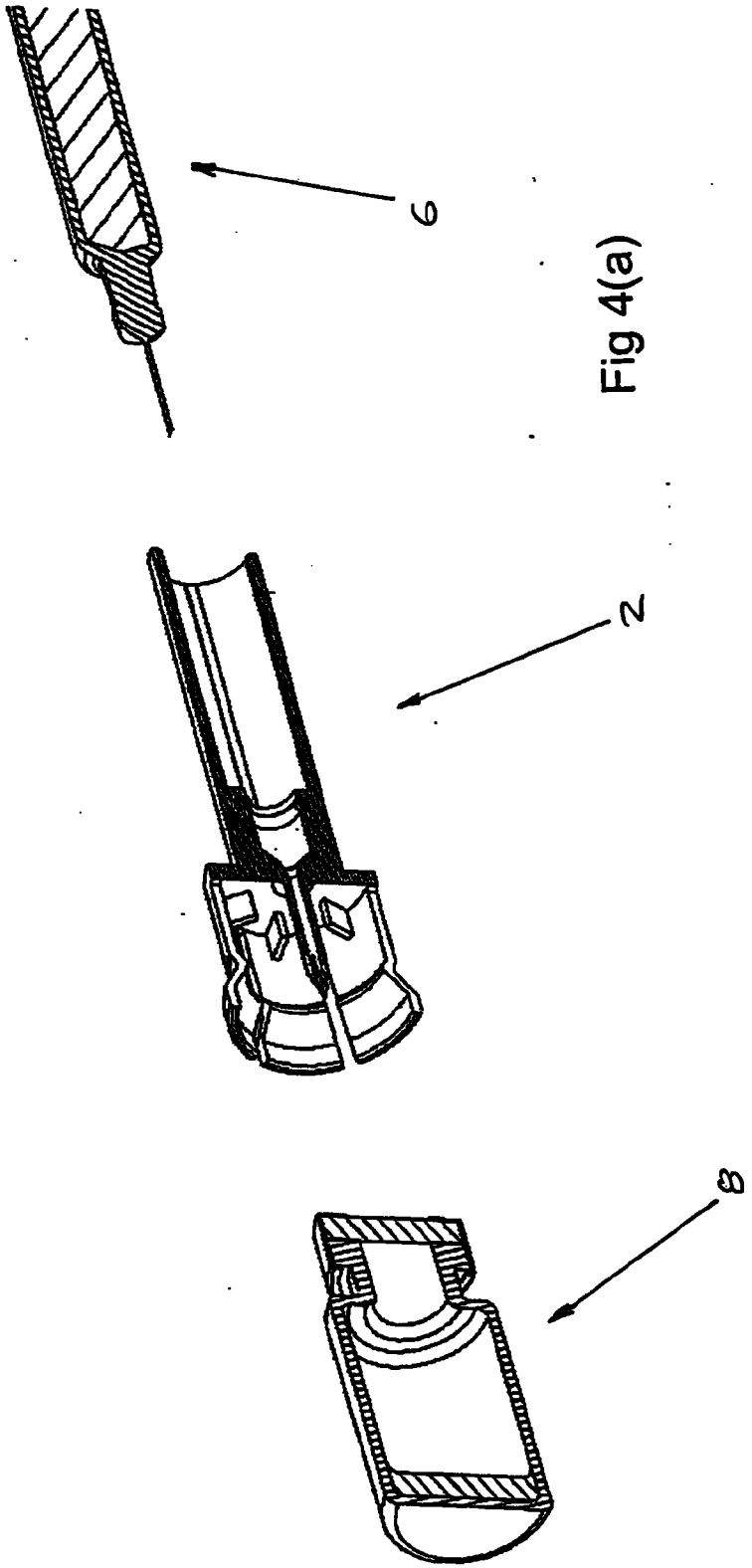


Fig 4(a)

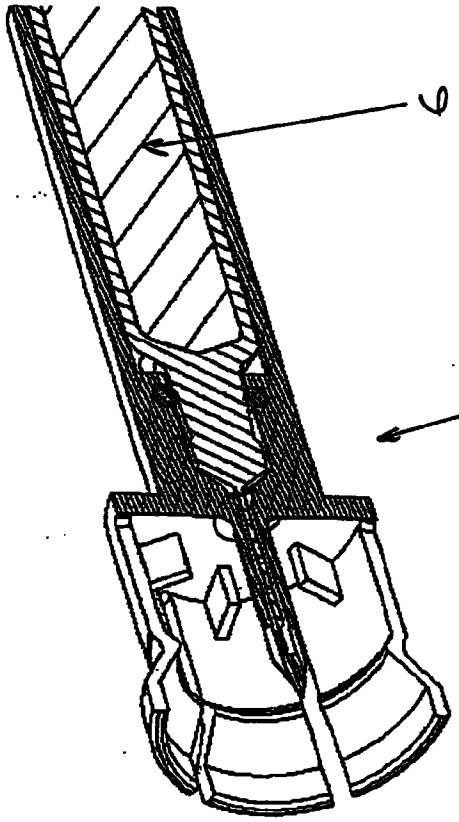
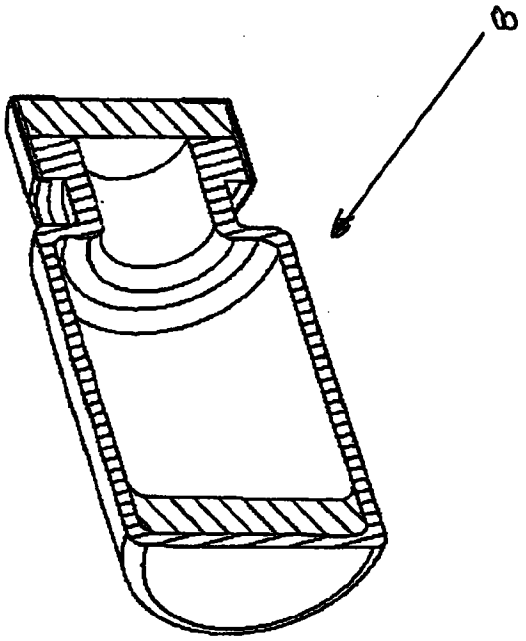


Fig 4(b)



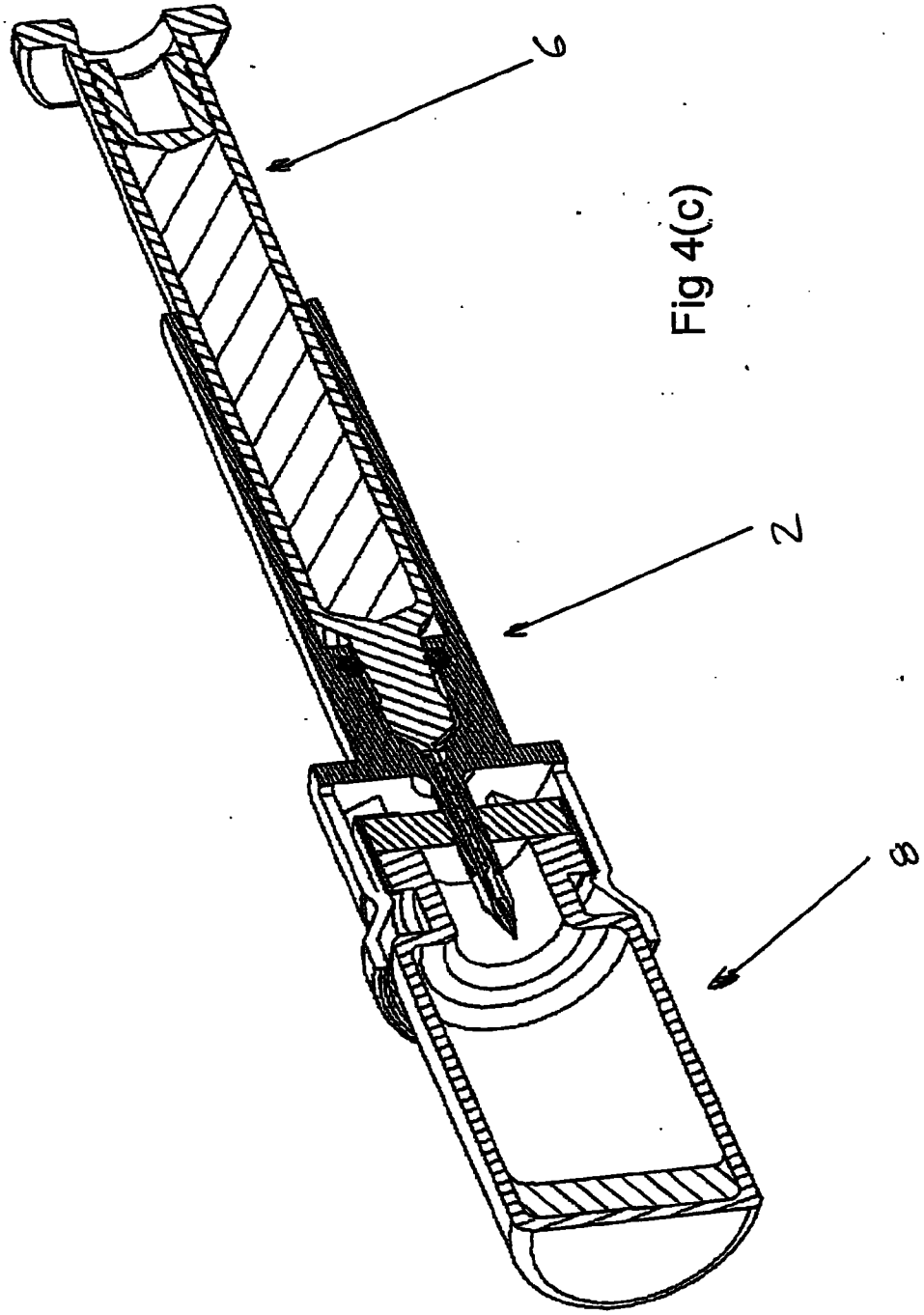


Fig 4(c)

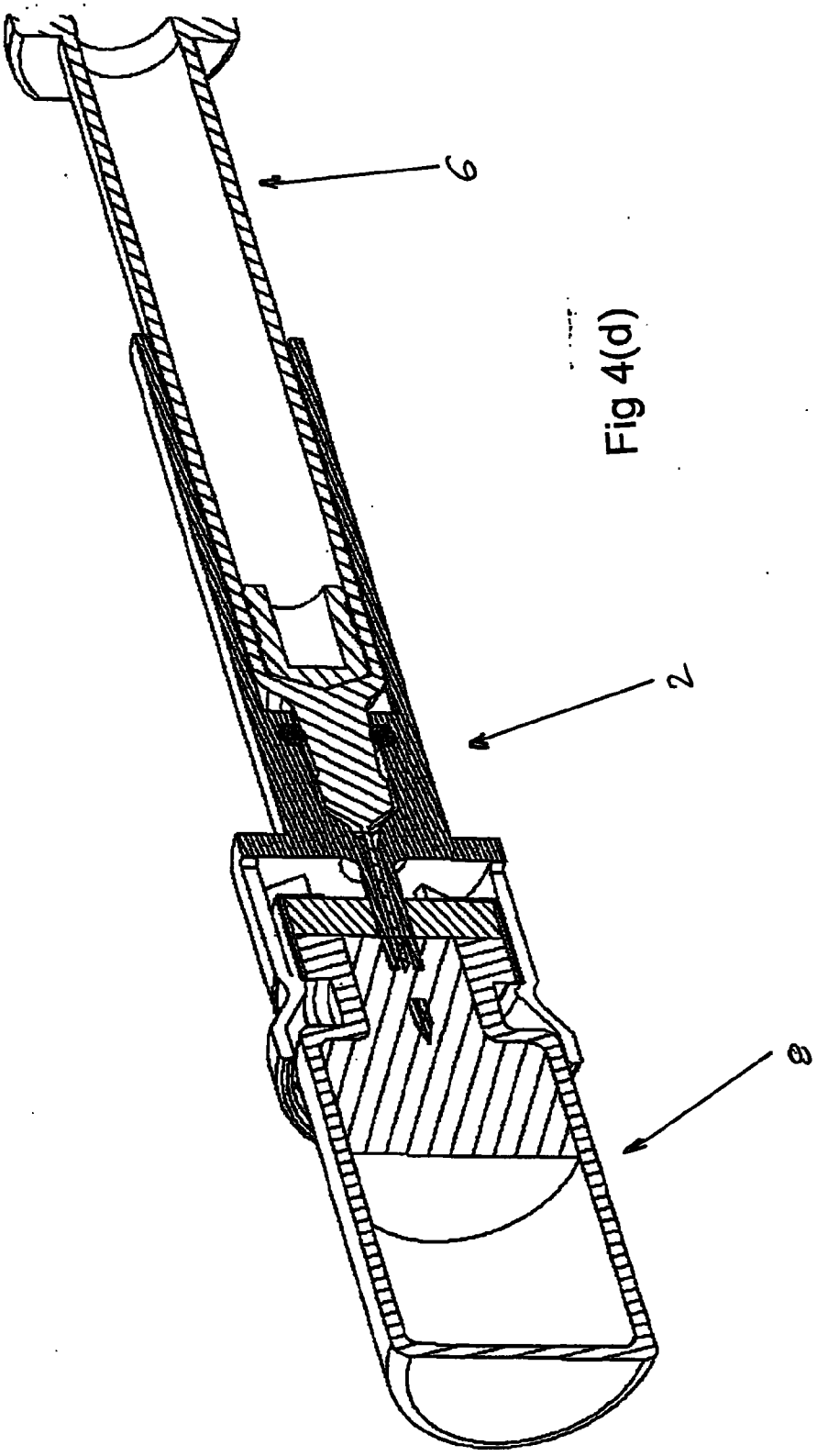


Fig 4(d)

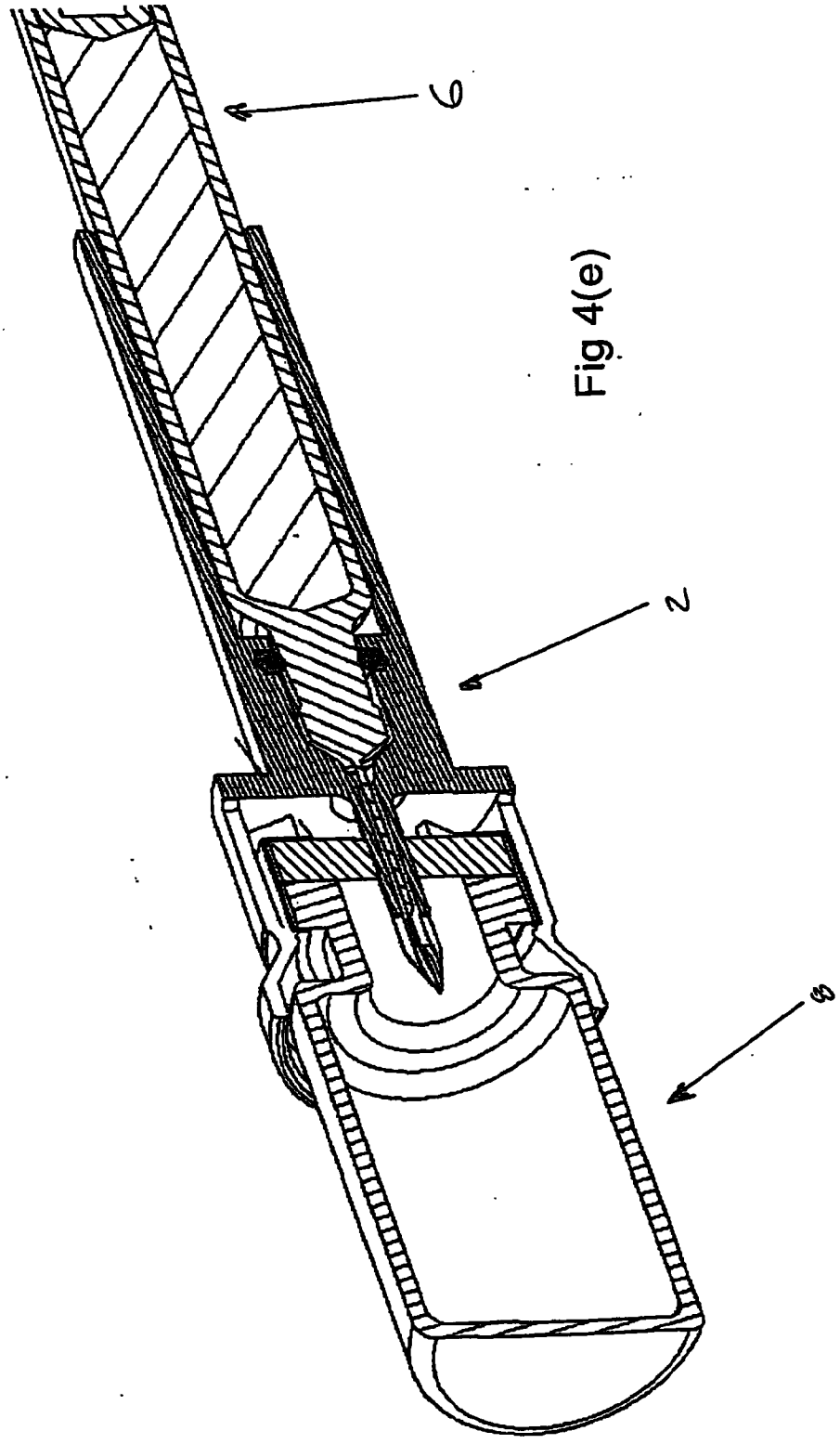


Fig 4(e)

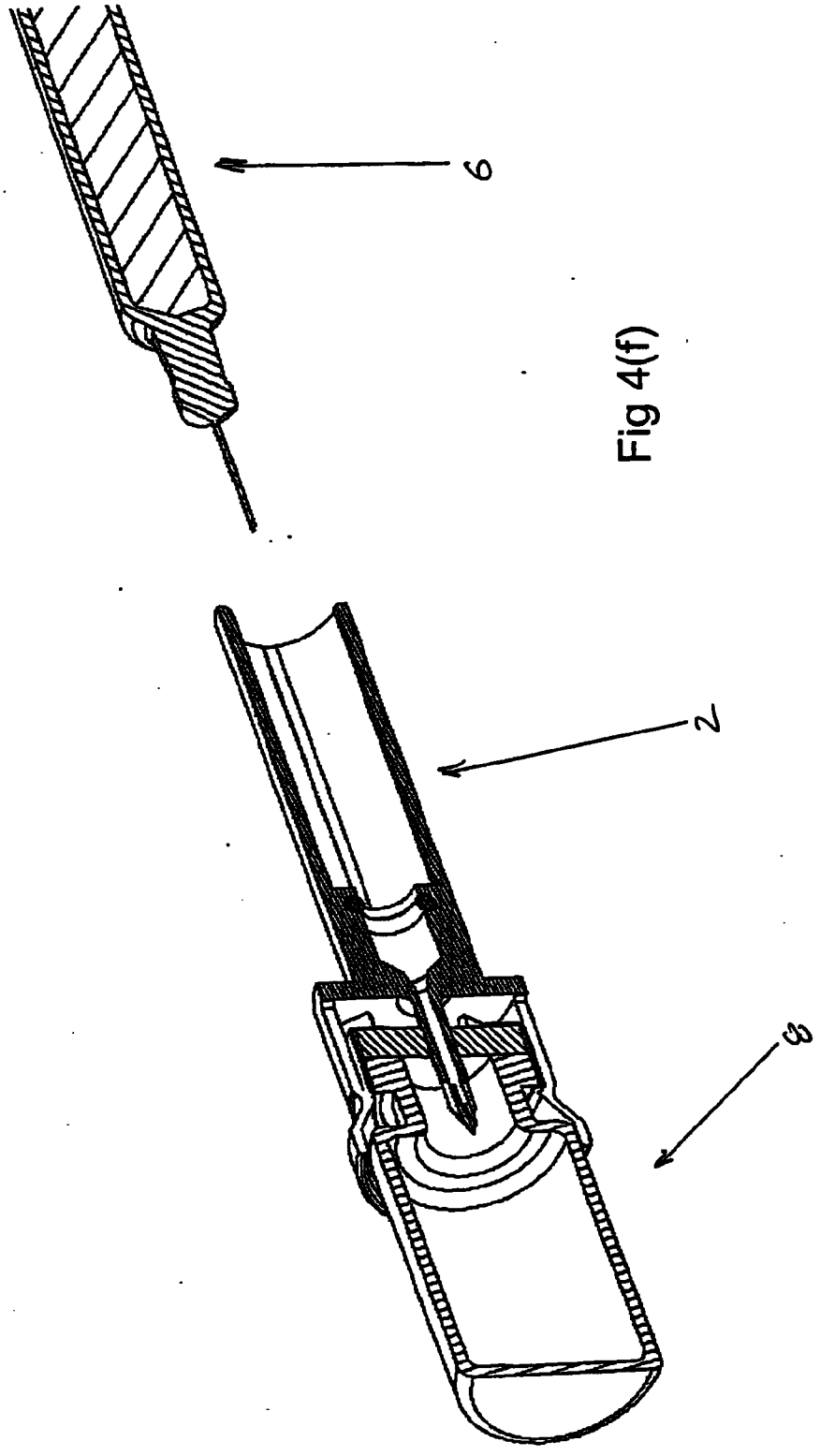


Fig 4(f)

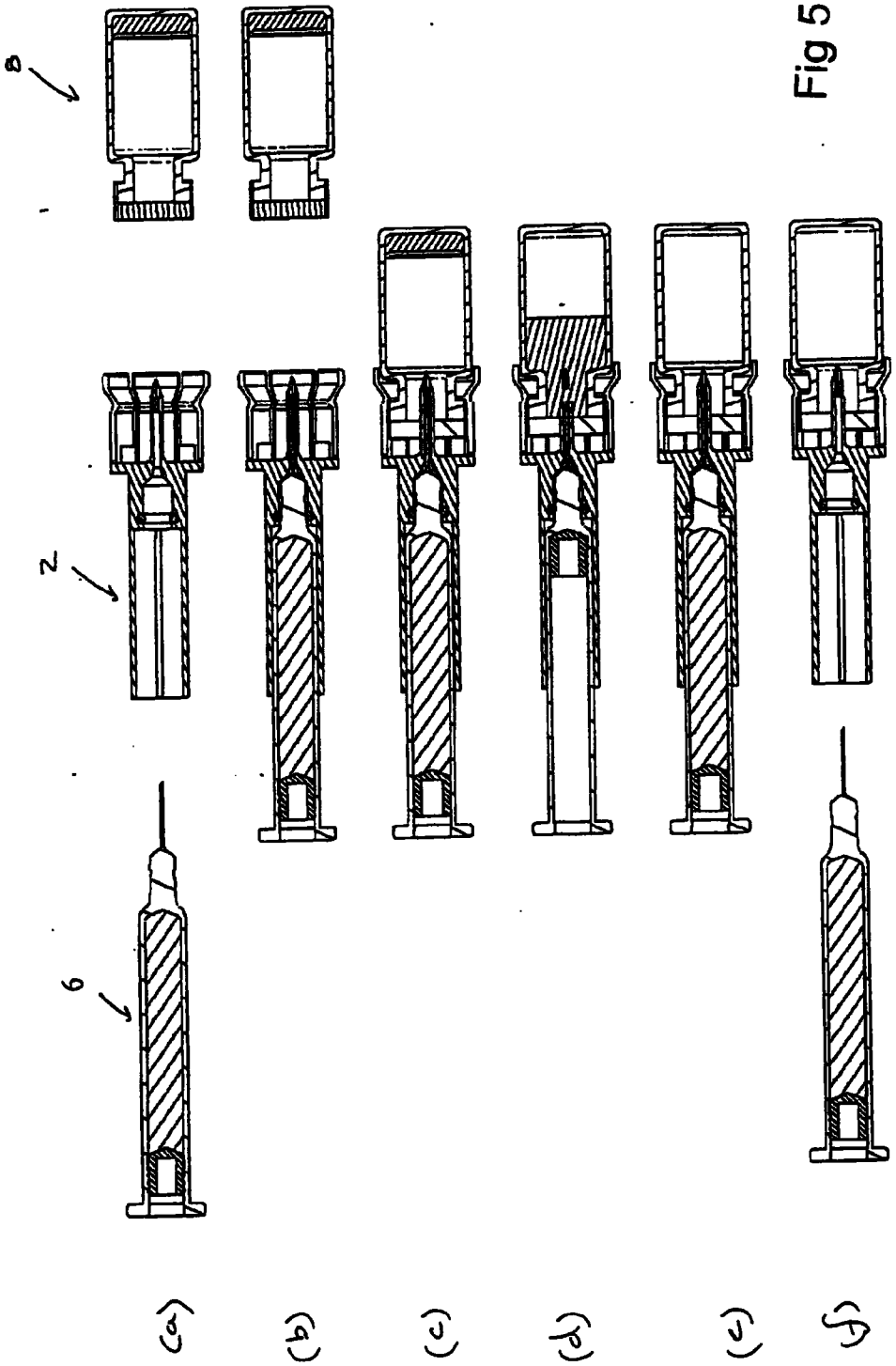


Fig 5

Fig.6.

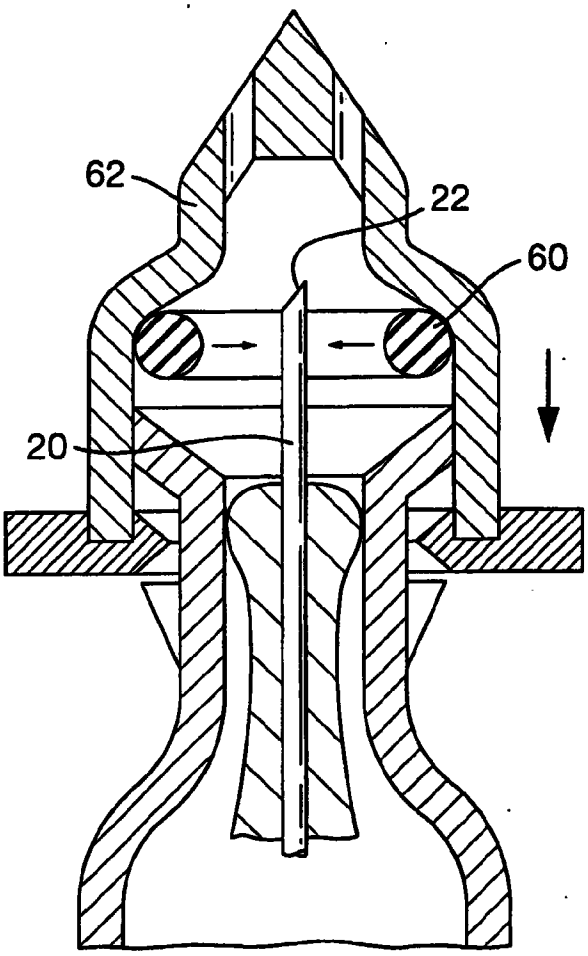
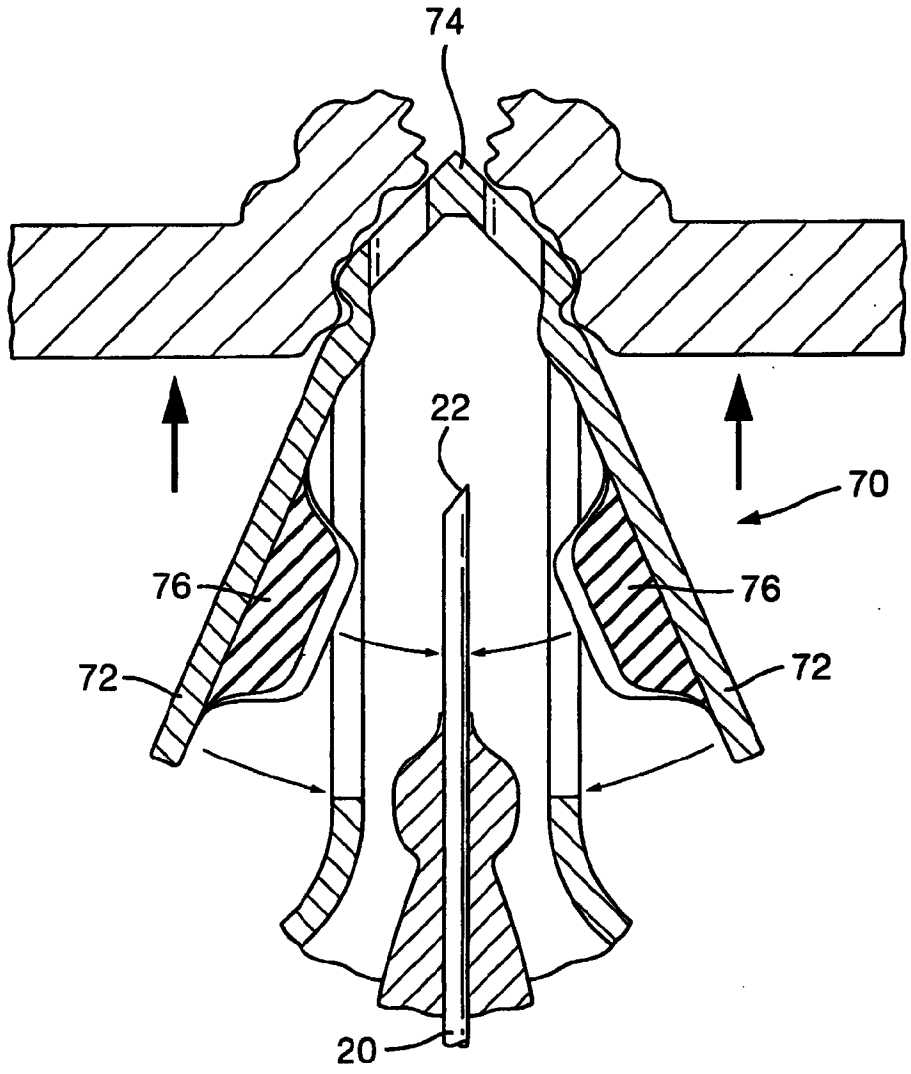


Fig.7.



SYRINGE ADAPTOR

The present invention relates to an adaptor for a syringe, in particular allowing the syringe to be placed in fluid communication with the contents of a vial.

Previously, it has been known to connect a syringe to a vial so as to allow the contents of the vial to be withdrawn into the syringe. For instance, it has been known to provide a syringe which is pre-filled with (sterile) water and a vial which is pre-filled with a lyophilised medicament. A user punctures the septum of the vial with the needle of the syringe and expels the water from the syringe into the vial. The mixed medicament may then be drawn back into the syringe using the same needle. Having withdrawn the needle from the vial, the mixed medicament is ready for dispensing to a patient.

Unfortunately, a problem with this arrangement is that puncturing the septum of the vial with the needle of the syringe will blunt the tip of the needle of the syringe. Also, there is a danger that a small portion of the septum may become detached during the puncturing process and remain on the needle as a subsequent danger to any patient using the needle.

In view of these problems, it has been proposed to provide a syringe with a replaceable needle. Hence, a user uses a first needle to puncture the septum of the vial and obtain the mixed medicament. The user then exchanges the first needle for a second needle before the syringe is used for dispensing the medicament to a patient. As an alternative, the first needle might be replaced by something described as a "straw" which similarly is used to puncture the septum of the vial.

Exchanging the straw or needle for the injection needle is troublesome to the user and increases the risk of accidental injury from the needle of the syringe.

Furthermore, the operation of using a needle to pierce a vial septum requires a level of skill that not all patients necessarily have, or may not be comfortable with when the medicament is required. As a result (due to varying depths at which a septum is pierced by a needle), it is possible that the user can influence the process of injecting the fluid into, or withdrawing fluid from, a vial and so affect the constitution or quantity of the medicament delivered.

Existing devices that seek to address these issues may require the use of costly, non-standard components or filling processes and may not ensure that the patient is injected using a needle that has not already been used to puncture a septum.

Of course, similar problems exist where an empty syringe is used to withdraw fluid medicament from a vial pre-filled with that fluid medicament.

It is an object of the present invention at least to reduce the problems of earlier arrangements.

According to the present invention, there is provided a method of using an adaptor for a syringe having an elongate body with an injection end from which a needle extends to a needle tip, the adaptor having a housing arranged to mount on and seal with the syringe so as to define with the syringe a cavity within which the needle of the syringe can extend without the needle tip contacting the housing and a puncture member extending from the housing and having at least one port arranged to provide fluid communication to the cavity, the method including puncturing the septum of a vial using the puncture member, drawing the contents of the vial into the syringe via the at least one port, the cavity and the needle and removing the syringe from the adaptor.

Where the adaptor is for use with a syringe containing water and a vial containing a lyophilised medicament, the method preferably further includes, between the steps of puncturing and drawing, expelling the water into the vial via the needle, the cavity and the at least one port so as to mix the water with the lyophilised medicament in the vial.

According to the present invention, there is also provided an adaptor for use with a syringe having an elongate body with an injection end from which a needle extends to a needle tip, the adaptor having:

a housing arranged to mount on and seal with the syringe so as to define with the syringe a cavity within which the needle of the syringe can extend without the needle tip contacting the housing; and

a puncture member extending from the housing, arranged to puncture a septum of a vial sealing an interior of the vial and having at least one port arranged to provide fluid communication between the interior of the vial and the cavity.

In this way, the needle of the syringe remains in a state suitable for penetrating the skin of a patient for injection purposes. In particular, the tip of the needle is prevented from contacting any surfaces which might blunt it. In particular, the puncture member of the adaptor is used to puncture the septum of a vial so that any stray material from the septum remains on the puncture member rather than the needle and the needle is not made blunt by the puncturing process. The adaptor provides fluid communication between the interior of the vial and the syringe such that the contents of the vial can be withdrawn into the syringe. The user then need only remove the adaptor from the syringe to place the syringe in a state ready for use. There is no need to exchange the needle fitted to the syringe with any other needle. In this respect, syringes may thus not require the needle to be exchangeable. More cheaply produced syringes having permanently fitted needles may be used.

It is possible for the needle to be provided in the injection end in a fixed manner. However, where the needle is fittable to the injection end, the needle can be inserted in the injection end.

It is possible for the housing to seal with the shaft of the needle of the syringe so as to form the cavity which connects to the at least one port. However, with such an arrangement, steps should be taken to avoid any seal from contacting the tip of the needle.

Preferably, however, the housing has a substantially circular opening for sealing with the injection end of the syringe. In this way, it is not necessary for the housing to have any contact with the needle.

Preferably, where the adaptor is intended for use with a syringe having, at the injection end, a neck portion from which the needle extends, the housing is arranged to seal with the neck portion.

As will be discussed below, a limited number of highly standardised syringes are well known and it is easy to arrange the adaptor for fitment and sealing with such syringes.

Preferably, the housing includes an inwardly facing O-ring for sealing with the syringe. This could seal with the shaft of the needle, but, preferably, seals with

the neck portion. Sealing with the shape of the needle can be advantageous in reducing lost volume.

Preferably, the housing includes a support member extending beyond the seal so as to engage an outer surface of the elongate body of the syringe and to provide support to the adaptor when mounted on the syringe.

In particular, the support member is intended to provide some structural integrity to the mounting between the adaptor and the syringe. Preferably, this prevents the adaptor from moving or tilting with respect to the axis of the syringe.

Preferably, the support member extends on opposite sides of the seal. In particular, it extends along opposite sides of the outer surface of the elongate body so as to prevent the adaptor tilting in either direction.

Preferably, the support member is substantially annular so as to fit around the outer surface of the elongate body of the syringe and thereby support the adaptor from tilting in any direction with respect to the axis of the syringe.

Preferably, the puncture member extends from the housing to a puncture portion shaped to puncture a vial septum, the at least one port being located at least proximate to the puncture portion and wherein the puncture member includes an internal surface defining a communication channel internally of the puncture member and extending from the at least one port to the cavity.

Thus, the puncture portion at the end of the puncture member can be used to puncture a vial septum. With the puncture portion then inside the vial and the at least one port located proximate to it, fluid communication is provided between the inside of the vial and the puncture member. The communication channel provided within the puncture member then connects the at least one port to the cavity so as to provide full fluid communication between the inside of the vial and the cavity of the adaptor.

Preferably, the puncture member includes an outer surface extending longitudinally from the housing to the puncture portion, the at least one port being defined in the outer surface at a position proximate to the puncture portion.

In other words, the puncture member preferably has an elongate form such as in the shape of a shaft, with the puncture portion at one end. The at least one port is

then defined or provided through the outer surface of that elongate form at a position proximate to the puncture portion.

Preferably, at least part of the communication channel forms part of the cavity such that the needle can extend into the communication channel without the needle tip contacting the housing or puncture member.

Thus, the division between the communication channel and the cavity is somewhat blurred. Both internal spaces are provided within the adaptor and are connected to one another. When the adaptor is connected to a syringe, the needle of the syringe extends through the space considered as the cavity and into the space considered as the communication channel where both of these spaces are in fluid communication with the at least one port.

Preferably, the communication channel is substantially cylindrical and is aligned with the housing so as to receive the needle of the syringe along substantially the length of the puncture member.

Thus, the space considered to be the cavity may be kept very small with the needle of the syringe extending internally along the length of the puncture member.

Preferably, the communication channel, cavity and housing are all coaxial.

It will be appreciated that some standard syringes have needles arranged coaxially with the elongate body of the syringe such that this arrangement of the adaptor allows the adaptor to be fitted coaxially with the syringe. This arrangement also works with larger syringes where the needle is off-centre with respect to the axis of the syringe body. In this case, mounting of the adapter to the syringe body is off-centre with the communication channel axis.

Preferably, the internal surface of the puncture member is arranged to be close fitting to the needle and the housing is arranged to be close fitting to the injection end such that the volume or space within the adaptor, between the adaptor and the syringe, is small.

Preferably, the volume or space should be made as small as possible according to tolerances of manufacture whilst ensuring that the tip of the needle does not contact either the puncture member or the housing. The space or volume within the adaptor will be dead volume where water or medicament is lost. Preferably, this

volume should be arranged to be no more than 5% of the volume of medicament for injection or volume of water for injection into the vial. Hence, for a total syringe volume of 1 millilitre, the lost volume should be no more than 50 micro litres. 3% or 1% are more preferable values.

Preferably, the at least one port includes two or more ports. These may be provided at different radial positions around the puncture member and/or different longitudinal positions along the length of the puncture member.

Preferably, the housing includes an attachment member extending substantially parallel with the puncture member so as to engage with a neck of a vial.

It will be appreciated that a range of standard vials are well known having a neck leading to an opening covered by the vial septum.

By allowing the adaptor to engage with the neck of a vial, the vial can be supported more securely to the adaptor so as to facilitate operation of the syringe while the puncture member remains inserted through the septum of the vial.

Preferably, the attachment member extends on opposite sides of the puncture member.

This provides a convenient way of attaching to and gripping the neck of the vial. The attachment member may be substantially annular so as to grip the neck of the vial substantially around its entire periphery.

The puncture member should not contact the body of the vial, for instance the glass housing. Thus, preferably, the puncture member is arranged to pierce the septum close to the centre of the septum. The attachment member maybe arranged so as to ensure this positioning.

Preferably, the attachment member includes a latch for non-releasably engaging with the neck of the vial.

In this way, the adaptor may be fitted to a vial, for instance by push fitting the attachment member over the neck of the vial. Preferably during this operation, the puncture member punctures the septum. By non-releasably engaging with the neck of the vial, it then becomes easy for the user to place the syringe in a state ready for use. In particular, the user merely pulls the syringe with respect to the vial. The

adaptor remains engaged with the neck of the vial and the syringe pulls away from the adaptor.

Preferably, the adaptor further includes a shield which is removably attached to the housing and arranged to cover the at least one port.

The shield thus keeps the needle of the syringe protected. For example, by covering the at least one port, the needle may be kept in a sterile environment.

Preferably, the shield is releasably engaged by the attachment member.

The adaptor is preferably arranged for use with one of the following standard types of syringe:

Bünder Glas (ReadyJect, Helvoet, Stelmi or West)

BD (Hypak, Plastipak, Epilor, Glaspak, Luer-Lok or Luer-Slip)

Exel International

HSW

Monoject

Popper (Micro-Mate, Perfektum or Micromatic)

Schott (Forma 2S, Forma 3S, Forma 3SN or TopPac)

Terumo

These may be in any of the following sizes: 0.3ml, 0.5ml, 1ml short/standard, 1ml long, 2ml, 3ml, 5ml, 10ml, 20ml, 30ml, 50ml, 60ml, 100ml (including coaxial and eccentric tip versions).

The adapter is preferably arranged for use with one of the following standard types of vial:

Schott

Becton

Dickinson

Qorpak

West Pharmaceutical (Westar closure components)

Tyco

Pacific Vial

These may be any of the standard vial sizes 0.3 ml, 0.5 ml, 1ml, 1.5ml, 2ml, 3ml, 4ml, 5ml, 10ml, 20ml, 40ml, 60ml.

An injection assembly may be provided including a syringe having an adaptor mounted on and sealing with the syringe at the injection end. In some embodiments, the syringe may be pre-filled with water.

The invention will be more clearly understood from the following description, given by way of example only, with reference to the accompanying drawings, in which:

Figure 1 illustrates an adaptor embodying the present invention and fitted to a syringe and a vial;

Figure 2 illustrates a cross-section through the assembly of Figure 1;

Figure 3 illustrates an enlarged section of Figure 2;

Figures 4(a) to (f) and 5(a) to (f) illustrate various stages of operation of the arrangement of Figure 1;

Figure 6 illustrates an alternative arrangement of a puncture member; and

Figure 7 illustrates a further alternative arrangement of a puncture member.

As illustrated in Figure 1, an adaptor 2 embodying the present invention may be fitted to the body 4 of a syringe 6. The adaptor 2 is then also fitted to or engages with a vial 8 by means of an attachment member 10.

Figure 2 illustrates the arrangement of Figure 1 in cross-section.

The syringe 6 is of standard construction and includes a cylindrical elongate body 4 having internal walls 12 defining an internal cylinder or cylindrical space 14 for containing a fluid. In the embodiment to be described, the syringe 6 is provided pre-filled with (sterile) water, but the present invention is not limited to this embodiment. In a standard way, a piston 16 is provided in the cylinder 14 and is movable along the inner walls 12 so as dispense fluid from the syringe 6 or to draw fluid into the syringe 6.

At a distal end, a finger flange 18 is provided in a standard manner. Although not illustrated, an elongate drive component may be provided which extends from the piston 16 out of the syringe body 4, past the finger flange 18 so as to allow operation of the piston 16.

At the opposite end of the syringe 6, described here as the injection end, a needle 20 is provided which extends axially from the syringe body 4 to a needle tip

22. This part of the arrangement is illustrated more clearly in the enlarged portion of Figure 2 which is illustrated in Figure 3.

In a standard manner, the body 4 of the syringe 6 is provided with a neck portion 24 between the cylinder 14 of the body 4 and the needle 20. Although not illustrated, a passageway is provided in the neck portion 24 connecting the cylinder 14 to the needle 20. In the normal manner, the needle 20 is a hollow shaft which provides fluid communication between the needle tip 22 and the passageway in the neck portion 24.

As illustrated, the adaptor 2 includes a housing 26 which is mounted onto the syringe 6.

In the illustrated embodiment, the housing 26 includes internal walls 28 which are located around the periphery of the neck portion 24 such that a cavity 30 is defined therebetween.

It would be possible for the housing 26 to seal with a portion of the shaft of the needle 20 or with the body 4 of the syringe 6. However, in the illustrated embodiment, the housing 26 is arranged to seal with the neck portion 24 of the syringe 6.

In the illustrated embodiment, an inwardly facing O-ring 32 is provided for sealing with the neck portion 24. In particular, an annular recess 34 is provided in the inner wall 28 of the housing 26 for receiving the O-ring. The O-ring 32 then seals with an outer surface of the neck portion 24.

The adaptor 2 is also provided with what will be described as a puncture member 36 which extends away from the housing 26 of the adaptor 2 and the syringe 6. The puncture member 36 is arranged to puncture a septum 38 of a vial 8. In particular, the puncture member 36 is provided with a puncture portion 40 at its end furthest from the housing 26. The puncture portion 40 is preferably pointed in some way so as easily to puncture the septum 38 of the vial 8. Ports 42 are provided in the outer surface 44 of the puncture member 36 and connect to a communication channel 46 defined by an internal surface 48 in the puncture member 36. Thus, the communication channel 46 provides fluid communication between the ports 42 and the cavity 30.

Notably, the puncture member 36 and housing 26 are arranged such that the needle tip 22 of the needle 20 does not contact either the inner surfaces 48 of the puncture member 36 or the inner surfaces 28 of the housing 26, even during installation of the syringe 6 with the adaptor 2. Thus, as long as the syringe 6 remains mounted to the adaptor 2, the needle tip 22 remains protected and can subsequently be used by a user for injection in a patient. The puncture member 36 allows the septum of a vial 8 to be punctured and to provide fluid communication to the cylinder 14 of the syringe 6 by means of the ports 42.

In some arrangements, the adaptor 22 may be arranged such that the needle 20 extends only into the cavity 30 of the housing 36 and not into the communication channel 46. As long as fluid communication is provided between the communication channel 46 and the cavity 30, the puncture member may then be positioned and orientated on the adaptor in any fashion. However, in the illustrated embodiment, efforts are taken to reduce volume of the cavity 30 and the volume in the communication channel 46 as these volumes are effectively "dead" and will contain fluid that will merely be lost.

Thus, in the illustrated embodiment, the communication channel 46 is provided coaxially with the cavity 30 such that the cavity 30 receives the neck portion 24 of the syringe 6 and the communication channel 46 receives the needle 20 along substantially the entire length of the communication channel 46.

As illustrated, the housing 26 and puncture member 36 are arranged such that, subject to practical constraints of construction, the inner surface 48 of the puncture member is as close as possible to the outer surface of the shaft 20 of the needle and the inner surface of the housing 28 is as close as possible to the outer surface of the syringe body 4, in particular the neck portion 24 of the syringe body 4 in the illustrated embodiment. In this way, losses of fluid or medicament may be minimised.

Before considering operation of the adaptor 2 some description is provided of two preferred features of the illustrated embodiment, namely, provision of a support member 50 for supporting the adaptor 2 relative to the syringe 6 and the attachment member 10 mentioned above.

As illustrated, so as to support the adaptor 2 relative to the syringe 6 when the adaptor 2 is mounted on and sealed with the syringe 6, a support member 50 is provided which extends beyond the seal towards the finger flange 18 end of the syringe 6 so as to engage with the outer surface of the body 4 of the syringe 6. Preferably, the support member 50 comprises a number of elongate longitudinally or axially extending arms for gripping the exterior of the body 4 of the syringe 6. More preferably, the support member 50 is a cylindrical extension of the housing 26 having an internal diameter arranged to receive and support the outer surface of the elongate body 4 of the syringe 6.

In this way, when the housing 26 is sealed to the syringe 6, the adaptor is held securely relative to the syringe 6, in particular preventing tilting of the adaptor 2 relative to the axis of the syringe 6.

The attachment member 10 extends away from the housing 26 in a direction away from the syringe 6 and substantially parallel with the puncture member 36.

The illustrated vial 8 is of a standard construction and includes a neck 52. As illustrated, the attachment member 10 is arranged to engage with the neck 52 of the vial 8. Preferably, the attachment member 10 extends on opposite sides of the puncture member 36 so as to engage with opposite sides of the neck 52 of the vial 8. In the illustrated embodiment, the attachment member 10 comprises a plurality of elongate legs which together form a substantially annular body surrounding the neck 52 of the vial 8. The elongate legs have some resilience or at least flexibility allowing them to deflect in a radially outward direction. Thus, as the adaptor 2 is pushed onto the vial 8 so that the puncture member 36 punctures the septum 38 of the vial 8, the legs of the attachment member 10 are deflected outwardly around the end of the vial 8 and then subsequently engage with the neck 52 of the vial 8 so as to secure the vial 8 in place with the puncture member 36 and its ports 42 inside the vial 8.

As illustrated, the attachment member is arranged to form a latch such that the attachment member 10 non-releasably engages with the neck 52 of the vial 8. In particular, as illustrated, the legs of the attachment member 10 are sloped gently outwardly in a direction such that when the end of the vial 8 is inserted between the

legs of the attachment member 10, those legs deflect outwardly around the end of the vial 8. However, the legs are sloped more steeply in the opposite direction such that once the legs of the attachment member 10 have engaged with the neck 52 of the vial 8, it becomes very difficult to remove the end of the vial 8 from the attachment member 10 of the adaptor 2.

There will now be given a description of use of the adaptor 2 in an embodiment where a syringe 6 is provided pre-filled with water for mixing with a lyophilised medicament provided in a vial 8.

Figures 4(a) and 5(a) illustrate the syringe 6, adaptor 2 and a vial 8 before assembly.

First, the syringe 6 is fitted into the adaptor 2 as illustrated in Figures 4(b) and 5(b). The housing 26 of the adaptor 2 seals with the syringe 6 and the needle 20 extends inside the communication channel 46 of the puncture member 36. It is envisaged that adaptors according to the present invention might be sold separately, but also that assemblies of a syringe with a fitted adaptor might also be sold.

As illustrated in Figures 4(c) and 5(c), the assembly of the syringe 6 and adaptor 2 may then be fitted to a vial 8. In particular, the septum end of the vial 8 is pushed between the legs of the attachment member 10 of the adaptor 2 such that the puncture portion 40 of the puncture member 36 punctures and penetrates the septum 38 of the vial 8 and the legs of the attachment member 10 engage with the neck 52 of the vial 8. Once in this configuration, the piston 16 may be driven along the cylinder 14 of the syringe 6 so as to expel the contents of water through the needle 20, cavity 30, communication channel 46 and ports 42 into the inside of the vial 8. This is illustrated in Figures 4(d) and 5(d).

After the water and lyophilised medicament in the vial 8 have been mixed, the piston 16 may then be withdrawn along the cylinder 14 of the syringe 6 so as to draw the mixed fluid back through the ports 42, communication channel 46, cavity 30 and needle 20 into the cylinder 14. This is illustrated in Figure 4(e) and 5(e).

A user may then pull the syringe 6 away from the adaptor 2 and vial 8, thereby exposing the needle 20 and needle tip 22 for the first time as illustrated in

Figures 4(f) and 5(f). By means of the latch provided by the legs of the attachment member 10, the adaptor 2 is held securely attached to the vial 8.

Although not illustrated, the adaptor 2 may additionally be provided with a shield which fits between the legs of the attachment member 10 so as to cover and protect the puncture member 36. In particular, the shield preferably covers and protects the ports 42 so as to maintain the needle 20 in a sterile environment. Use of the shield may be particularly advantageous when the assembly of syringe 6 and adaptor 2 illustrated in Figures 4(b) and 5(b) is sold as a single unit. A user receives the assembly of the syringe 6 and adaptor 2 with a shield fitted. The shield is then removed from the attachment member before the adaptor is then fitted to a vial.

Figure 6 illustrates an alternative construction for the puncture member whereby sealing occurs with the outer surface of the shaft of the syringe needle, in addition to or rather than with the body of the syringe. In this respect, the puncture member can itself be considered to be part of the housing, the cavity being formed between the puncture member and the needle.

As illustrated in Figure 6, the adapter is two separate pieces that slide together. The first piece is in direct contact with the syringe body and the second piece pierces the vial septum.

As illustrated in Figure 6, an O-ring 60 is provided within the puncture member 62. When the puncture member 62 is pressed against the septum of a vial to puncture the vial, the puncture member 62 reacts or is forced backwards so as to move the O-ring 60 inwardly and seal against the outer surface of the shaft of the needle 20. The two sections of the adapter move towards one another until they are (unreleasably) locked together to hold the O-ring seal in contact with the needle. Because the O-ring is in its expanded state when the needle 20 is fitted inside the puncture member 62, there is no danger of the tip 22 of the needle 20 contacting inner surfaces of the adaptor. This adapter can be designed so that the force required to pierce the septum exceeds that required to lock the adapter so that the adapter reaches its locked state before the vial is pierced. Withdrawing the needle with the O-ring in contact will not blunt the needle tip due to the direction of travel.

Figure 7 illustrates another alternative arrangement of a puncture member where sealing between the adaptor and the syringe again occurs on an outer surface of the needle 20. In this arrangement, the puncture member 70 includes at least two opposing legs 72 which are hinged at a position proximate the puncture portion 74. As the puncture portion 74 is pushed through the septum of a vial, the septum of the vial acts on the legs 72 so as to push them inwardly in a radial direction. The legs 72 could have compliant material to achieve seal with needle. The legs 72 are provided with seals 76 for sealing against the outer surface of the shaft of the needle 20. Thus, with the puncture member 70 in its inserted position through the septum of the vial, the legs 72 are held inwardly so that the seals 76 seal against the needle 20 and define the required cavity. Where only two legs 72 are provided, then each seal 76 makes up half of the complete seal around the needle 20. However, it will be appreciated that three or more legs could be provided, each with their proportionate amount of seal. As with the embodiment of Figure 6, during insertion of the needle 20 into the puncture member 70, there is no danger of inner surfaces of the puncture member 70 contacting the needle tip 22 during assembly. Furthermore, lost volume is significantly reduced. Indeed, if an appropriate seal is present elsewhere, the legs of this arrangement could be used merely to reduce the lost volume.

Another method for closing out the dead volume is to expand/contract flexible sections of the adapter or by advancing a ring-like part of the adapter distally to close out volume.

CLAIMS

1. An adaptor for use with a syringe having an elongate body with an injection end from which a needle extends to a needle tip, the adaptor having:

a housing arranged to mount on and seal with the syringe so as to define with the syringe a cavity within which the needle of the syringe can extend without the needle tip contacting the housing; and

a puncture member extending from the housing, arranged to puncture a septum of a vial sealing an interior of the vial and having at least one port arranged to provide fluid communication between the interior of the vial and the cavity.

2. An adaptor according to claim 1 wherein the housing has a substantially circular opening for sealing with the injection end of the syringe.

3. An adaptor according to claim 1 or 2 for use with a syringe having, at the injection end, a neck portion from which the needle extends, the housing being arranged to seal with the neck portion.

4. An adaptor according to claim 1, 2 or 3 wherein the housing includes an inwardly facing O ring for sealing with the syringe.

5. An adaptor according to any preceding claim wherein the housing includes a support member extending beyond the seal so as to engage an outer surface of the elongate body of the syringe and to provide support to the adaptor when the adaptor is mounted on the syringe.

6. An adaptor according to claim 5 wherein the support member extends on opposite sides of the seal.

7. An adaptor according to claim 6, wherein the support member is substantially annular.

8. An adaptor according to any preceding claim wherein the puncture member extends from the housing to a puncture portion shaped to puncture a vial septum, the at least one port being located at least proximate the puncture portion and wherein the puncture member includes an internal surface defining a communication channel internally of the puncture member and extending from the at least one port to the cavity.

9. An adaptor according to claim 8 wherein the puncture member includes an outer surface extending longitudinally from the housing to the puncture portion, the at least one port being defined in the outer surface at a position proximate to the puncture portion.

10. An adaptor according to claim 8 or 9 wherein at least part of the communication channel forms part of the cavity such that the needle can extend into the communication channel without the needle tip contacting the housing or puncture member.

11. An adaptor according to claim 10 wherein the communication channel is substantially cylindrical and is aligned with the housing so as to receive the needle of the syringe along substantially the length of the puncture member.

12. An adaptor according to claim 10 or 11 wherein the communication channel, cavity and housing are all coaxial.

13. An adaptor according to any one of claims 8 to 12, wherein the internal surface of the puncture member is arranged to be close fitting to the needle and the housing is arranged to be close fitting to the injection end such that a volume within the adaptor, between the adaptor and the syringe, is small.

14. An adaptor according to claim 13 wherein the volume is no more than 5% of the syringe volume.

15. An adaptor according to any preceding claim wherein the at least one port includes two or more ports.

16. An adaptor according to any preceding claim wherein the housing includes an attachment member extending substantially parallel with the puncture member so as to engage with a neck of a vial.

17. An adaptor according to claim 16, wherein the attachment member extends on opposite sides of the puncture member.

18. An adaptor according to claim 17, wherein the attachment member is substantially annular.

19. An adaptor according to claim 16, 17 or 18, wherein the attachment member includes a latch for non-releasably engaging with the neck of a vial.

20. An adaptor according to any one of claims 16 to 19 further including a shield releasably engaged by the attachment member and arranged to cover at least the at least one port.

21. An adaptor according to any one of claims 1 to 19 further including a shield removably attached to the housing and arranged to cover the at least one port.

22. An injection assembly including:

a syringe having an elongate body with an injection end from which a needle extends to a needle tip; and

an adaptor according to any preceding claim mounted on and sealing with the syringe at the injection end.

23. An injection assembly according to claim 22 wherein the syringe contains water.

24. An injection assembly according to claim 22 or 23 in combination with a vial.

25. An injection assembly according to claim 24 wherein the vial contains a lyophilised medicament.

26. A method of using an adaptor according to any one of claims 1 to 21 with a syringe having an elongate body with an injection end from which a needle extends to a needle tip, the adaptor being mounted on and sealing with the syringe, the method including:

puncturing the septum of a vial using the puncture member;

drawing the contents of the vial into the syringe via the at least one port, the cavity and the needle; and

removing the syringe from the adaptor.

27. A method according to claim 26 for use with a syringe containing water and a vial containing a lyophilised medicament, the method further including:

between the steps of puncturing and drawing, expelling the water into the vial via the needle, the cavity and the at least one port, so as to mix the water with the lyophilised medicament in the vial.

28. An adaptor constructed and arranged substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

29. An injection assembly constructed and arranged substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

30. A method of using an adaptor substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

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Application No:	GB0701964.9	**Examiner:**	Paul Jenkins
Claims searched:	1-30	**Date of search:**	8 May 2007

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-27	US 2005/0137523 A1 (WYATT) Whole document relevant see especially paragraphs 28-34
X	1-15 & 21-27	US 3796218 A (BURKE) Whole document relevant see especially the fig 3 embodiment and its associated description

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

A61J

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC

International Classification:

Subclass	Subgroup	Valid From
A61J	0001/00	01/01/2006